Renewable Energies Driven by Feed-in Tariffs: Photovoltaic vs. Wind Energy Development in Spain

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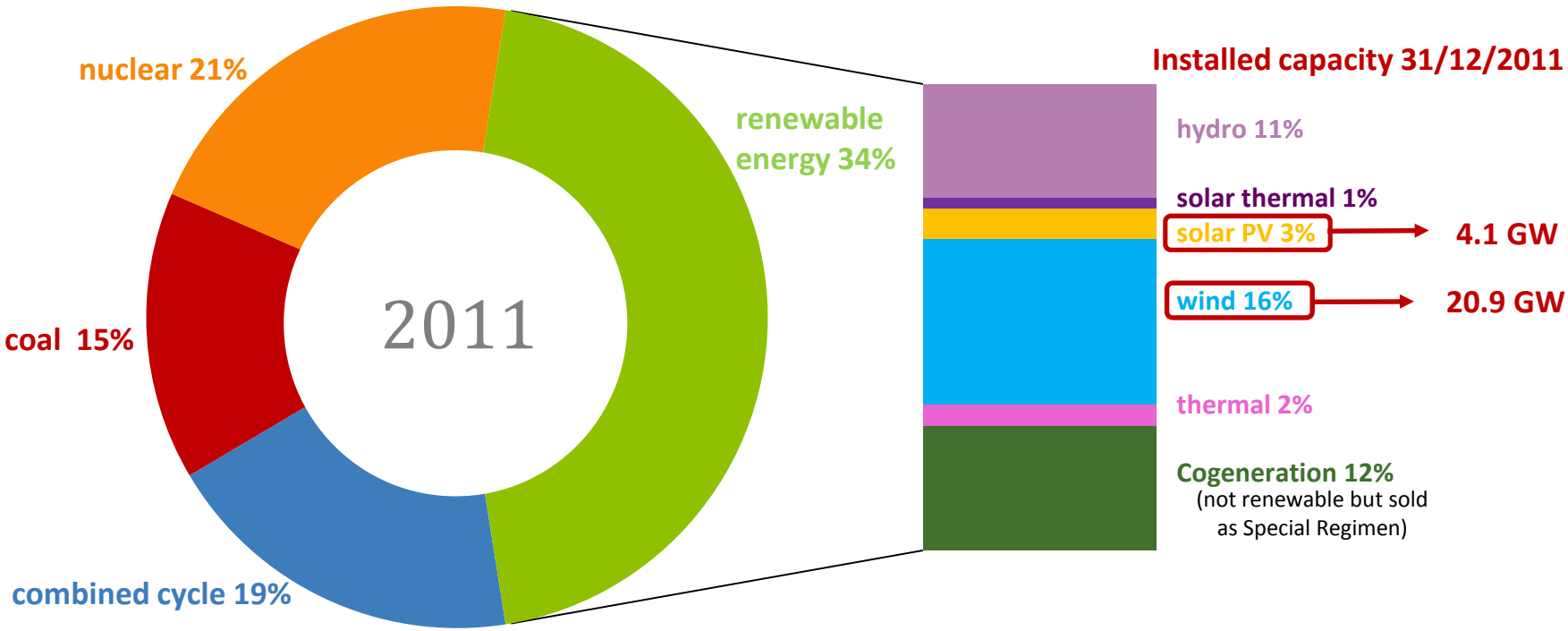
Outline

- Historical evolution of PV regulations
- Comparison with Wind Energy
- Benefits from feed-in tariffs: the merit-order effect
- The next future for wind and PV in Spain

Energy generation mix in Spain



Ref: *El sistema eléctrico español. Avance del informe 2011. Red Eléctrica de España*

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Historical evolution of PV regulations

1998 **RD 2818/1998**

1999 Renewable Energy National Plan 2000-2010

2004 RD 436/2004

2007 RD 661/2007

2008 RD 1578/2008

2010 RD 1003, RD1565, RD-L14

2011 New renewable Energy National Plan 2011-2020

2012 RD 1699

R.D.2818

- Feed-in tariff: 36 cents€/kWh
- Low impact

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Renewable Energy National Plan 2000-2010 or "statement of intent"

-PV objective (2010): 143.7MW

(400MW when it was actualized in 2005)

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R.D. 436/2004

- Feed-in tariff: 300% average tariff (>100kW$_p$)
  575% average tariff (<100kW$_p$)
- No quotes

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Historical evolution of PV regulations

1998 RD 2818/1998

1999 Renewable Energy National Plan 2000-2010

R.D.661 or the "PV boom"

-Feed-in tariff: 44.04 cents€/kWh (<100kW$_p$)
41.75 cents€/kWh (>100kW$_p$)
22.97 cents€/kWh (>10MW$_p$)

- No quotes

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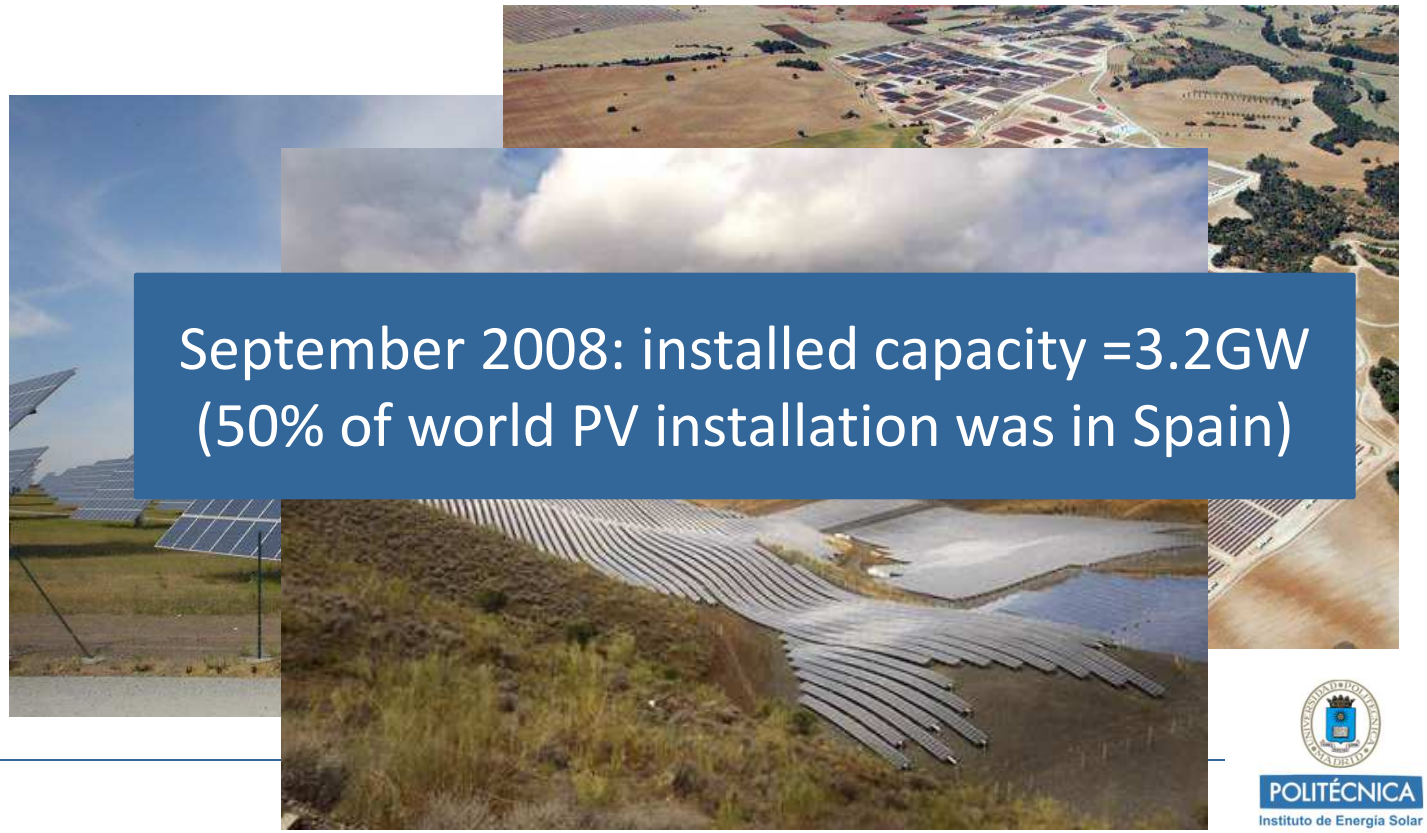

September 2008: installed capacity =3.2GW
(50% of world PV installation was in Spain)

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Historical evolution of PV regulations

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R.D.1578 or "the brakes"

-Feed-in tariff: 34cents€/kWh (rooftops<20kW$_p$)

2004 RD 436/2004

32 cents€/kWh (rooftops>20kW$_p$)

2007 RD 661/2007

32 cents€/kWh (ground)

2008 RD 1578/2008

2010 RD 1003, RD1565, RD-L14

- Decreasing feed-in tariff

2011 New renewable Energy National Plan 2011-2020

- Annual quotes: 500MW$_p$ (waiting list up to 2015)

2012 RD 1699

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2010	**RD 1003, RD1565, RD-L14**
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R.D.-L 14/2010 or "the equivalent hours limitation"

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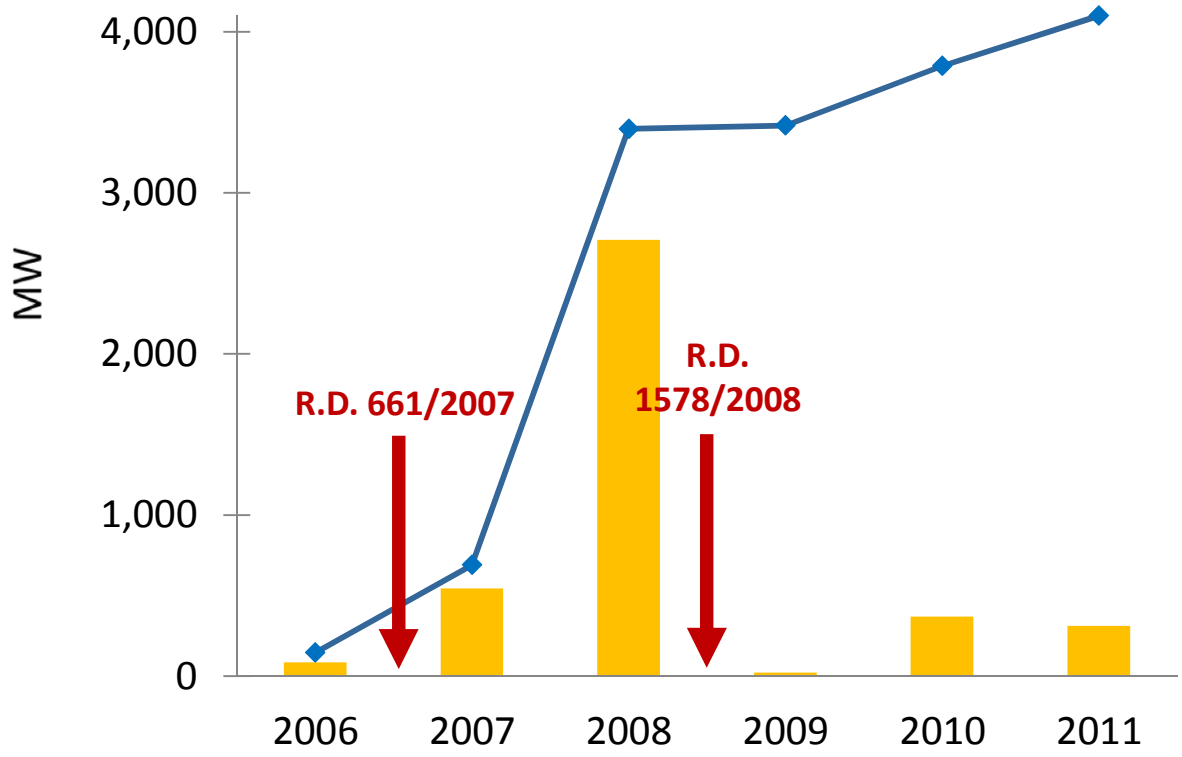

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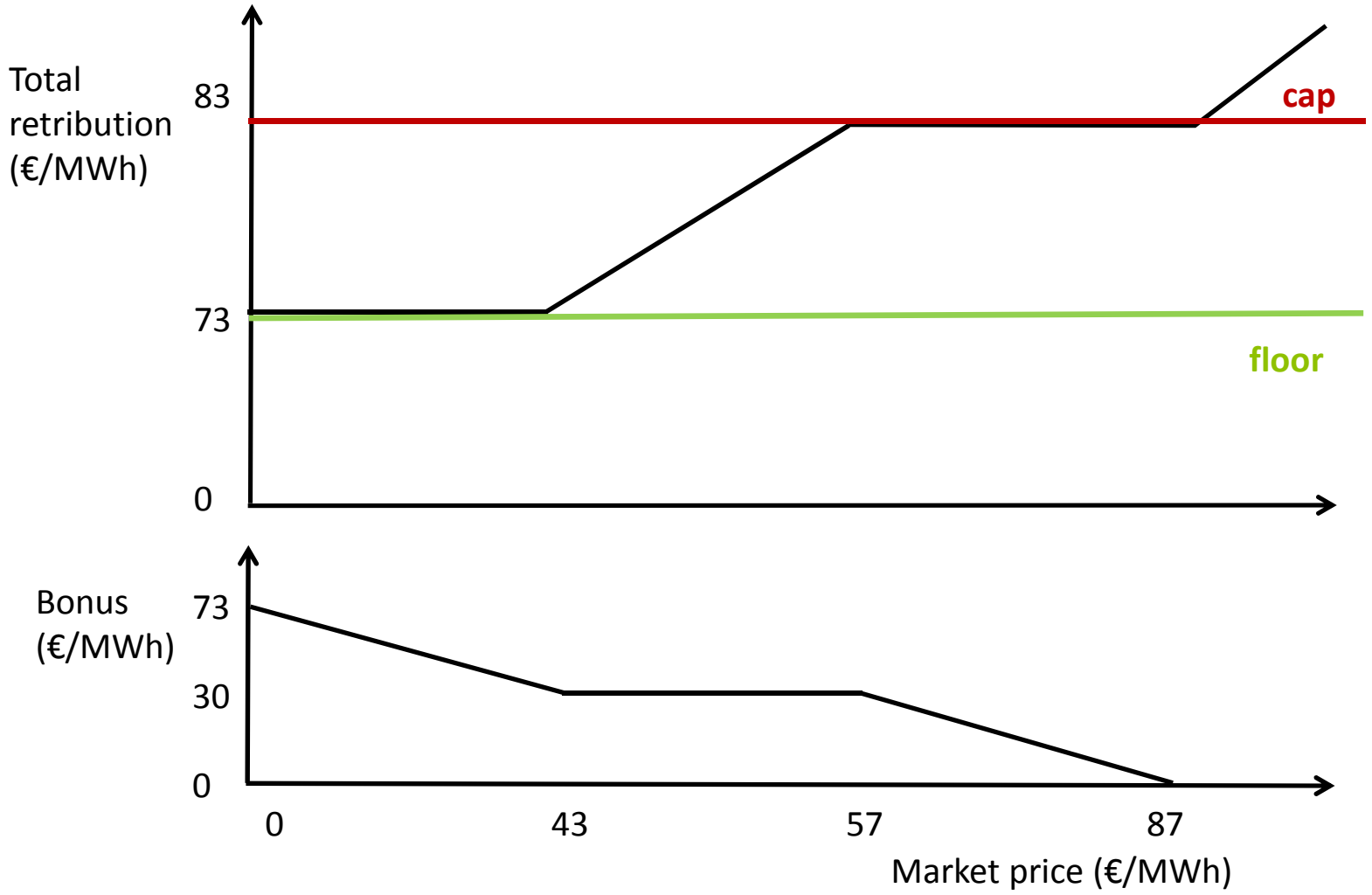
Evolution of wind energy installed capacity

R.D.661/2007 wind generators can choose: feed-in tariff or market+bonus

95%



Ref: Retribución energías renovables Comisión Nacional de Energía, 2009

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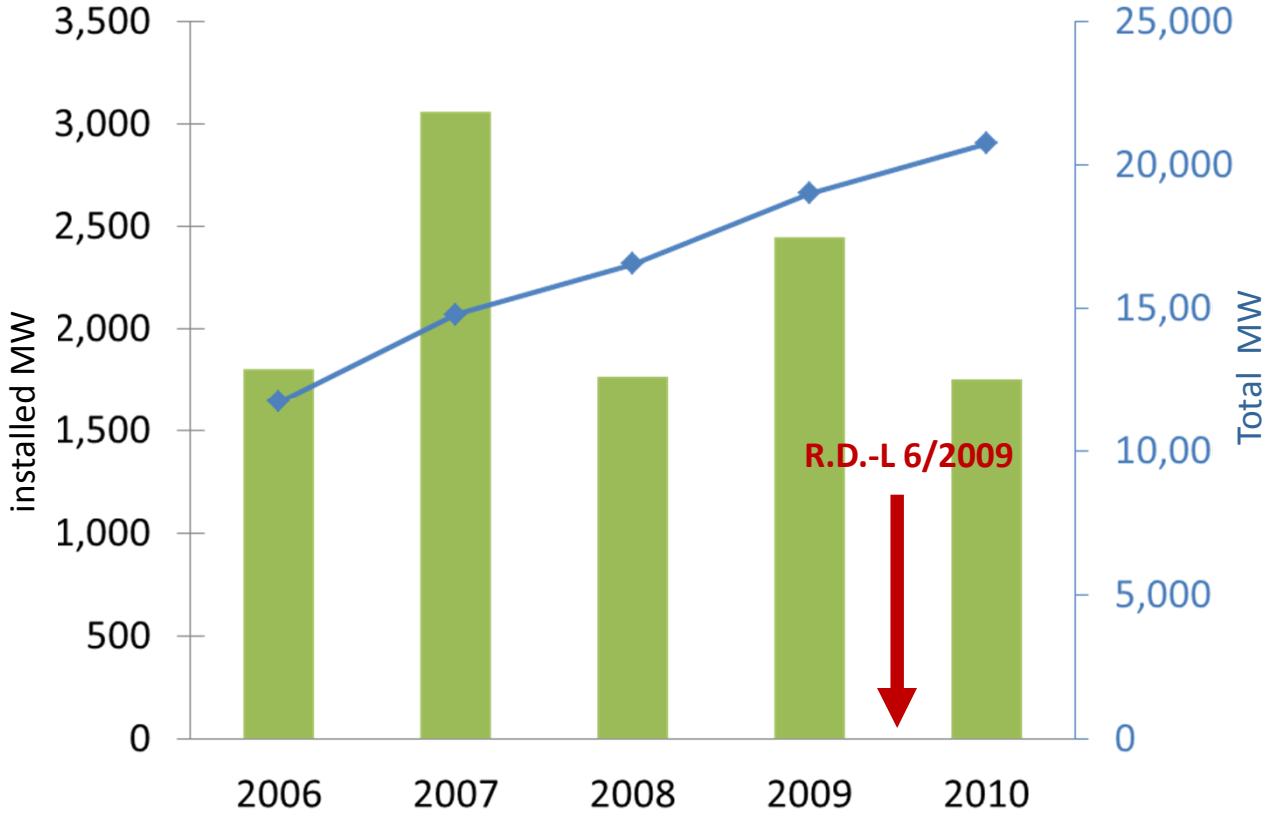
Evolution of wind energy installed capacity

R.D.-L 6/2009

quotes for wind energy under R.D.661/2007:
1855MW (2010),
1700MW (2011),
1700MW (2012)
… after?



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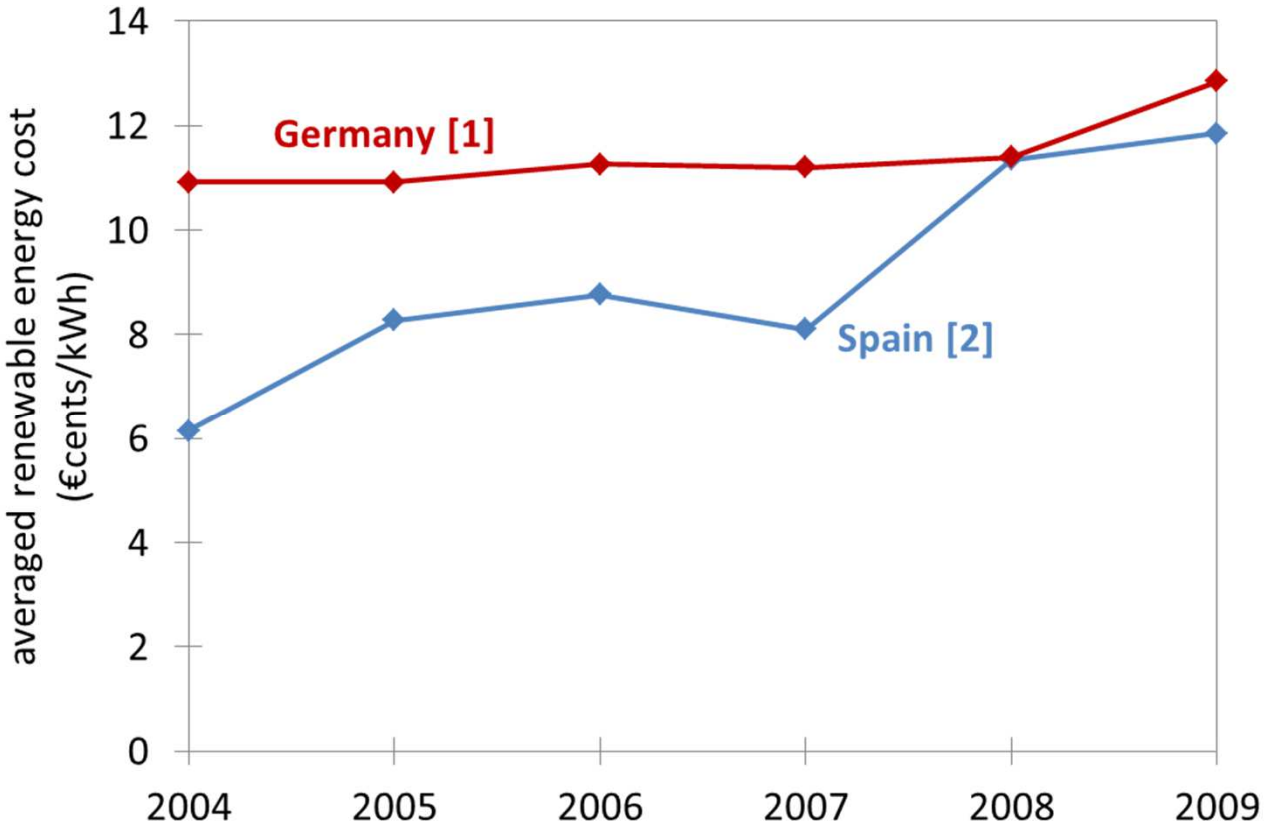
What are consumers paying for renewable energy?



[1] Working group on renewable energy statistics (AGEE-Stats)
[2] Retribución de las energías vendidas en Régimen Especial, CNE 2009

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Electricity prices for consumers in Spain

Regulated component (50%) + Market component (50%)

-Transport and distribution

- System and market operator

- Carbon subsidies

- Nuclear subsidies

- Renewable energy subsidies
  - Fossil fuel importation savings
  - CO_2 emissions savings
  - The merit-order effect

Ref: *Información básica de los sectores de la Energía. Informes anuales CNE 1988-1997*

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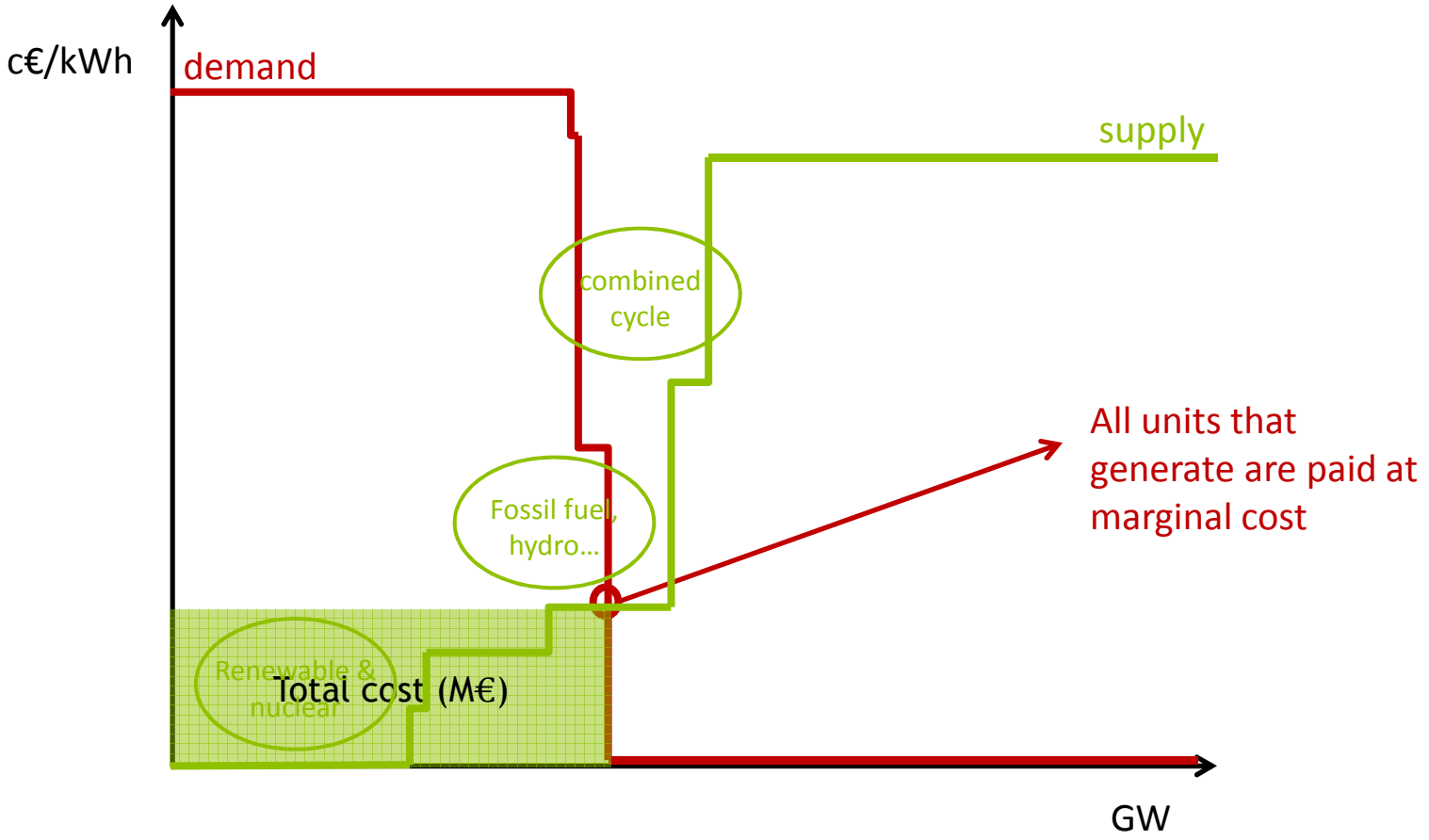
Market prices in Spain



Ref: http:// www.omel.es

Uniform-pricing vs pay-as-bid in wholesale electricity markets does it make a difference?, S. Tierney, T. Schatzki and R.Mukerji, Analysis group, 2008

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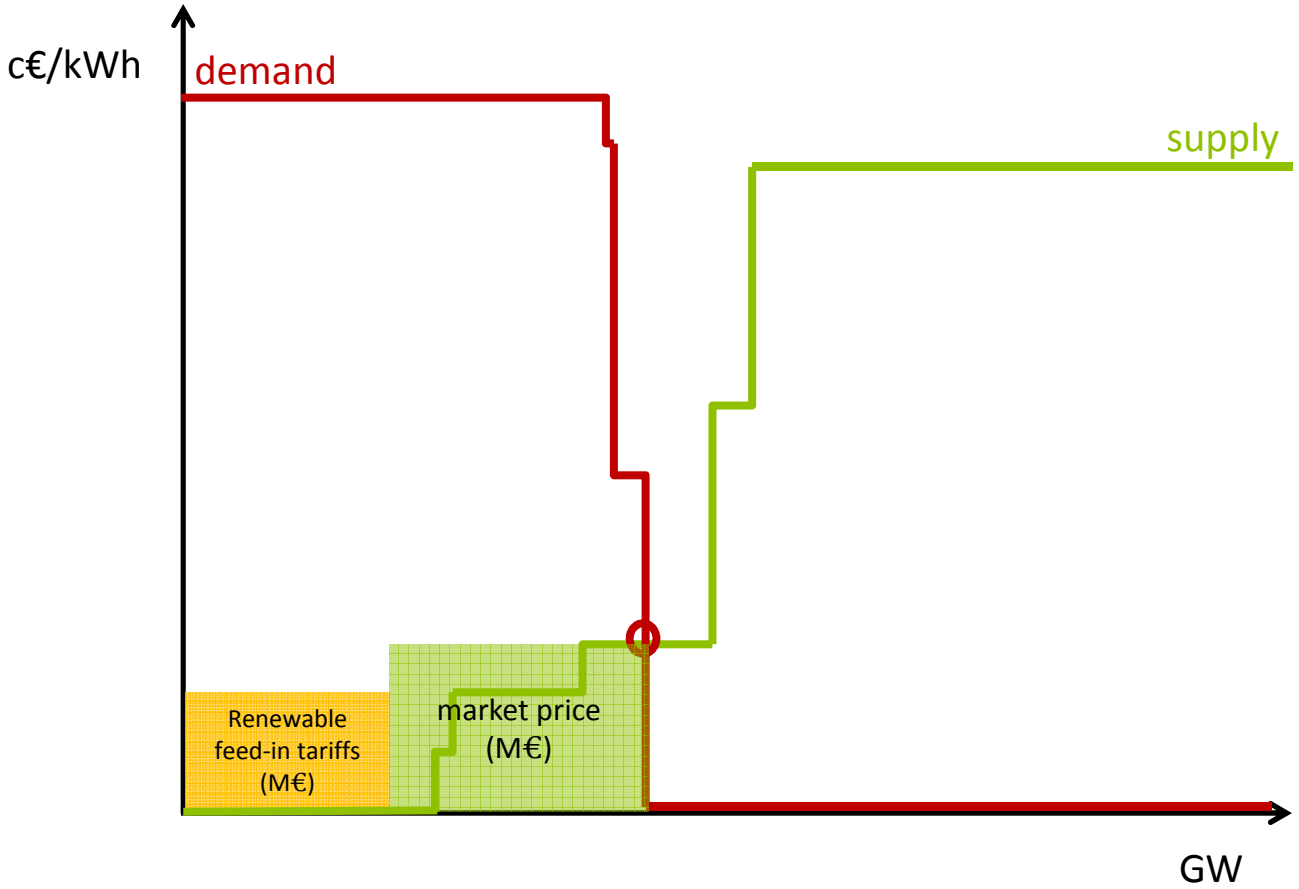
Benefits from feed-in tariffs: The “merit-order” effect



Consumers pay:

Renewable
Feed-in tariffs
(M€)

+

market price
(M€)

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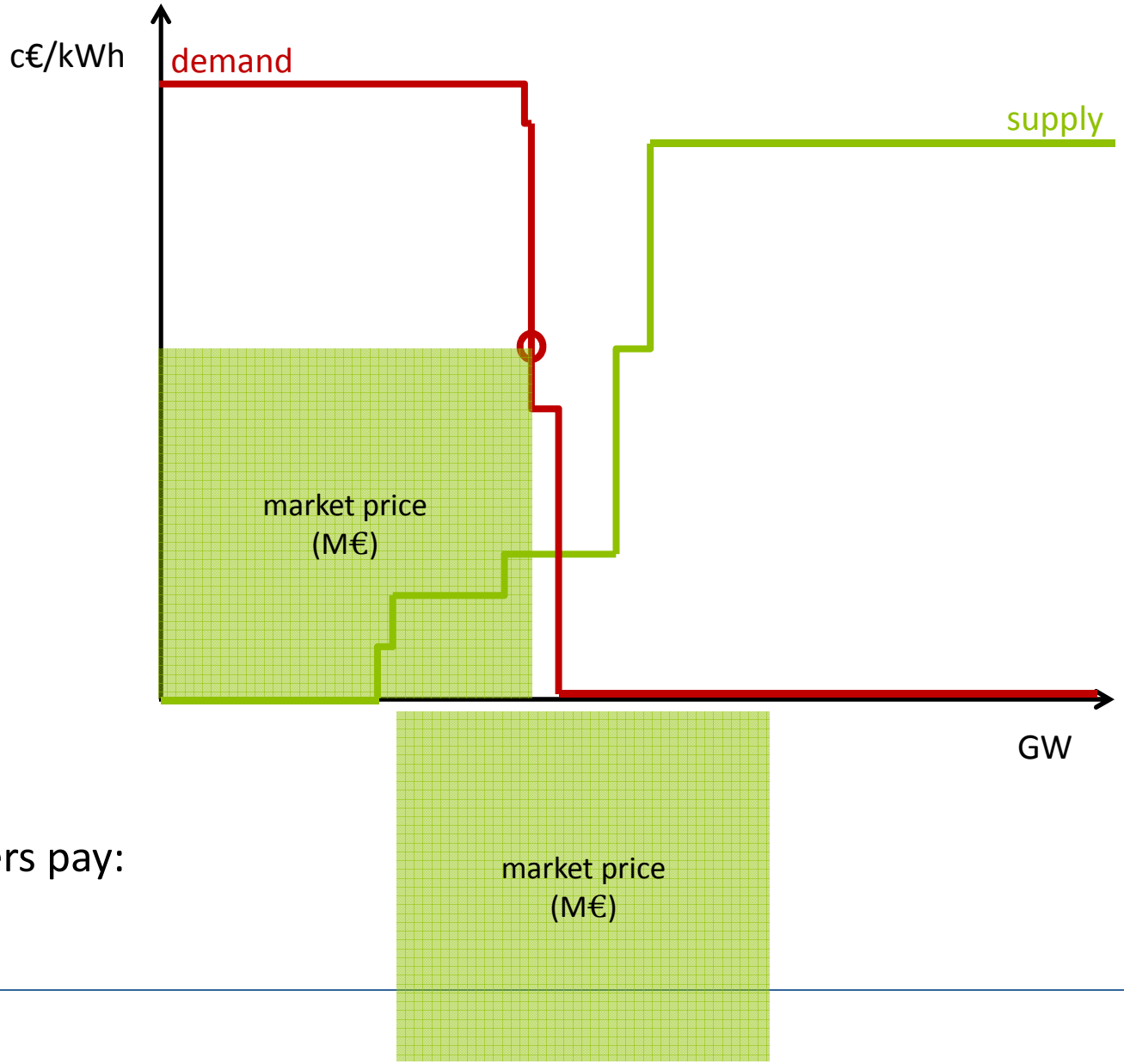

Consumers pay:

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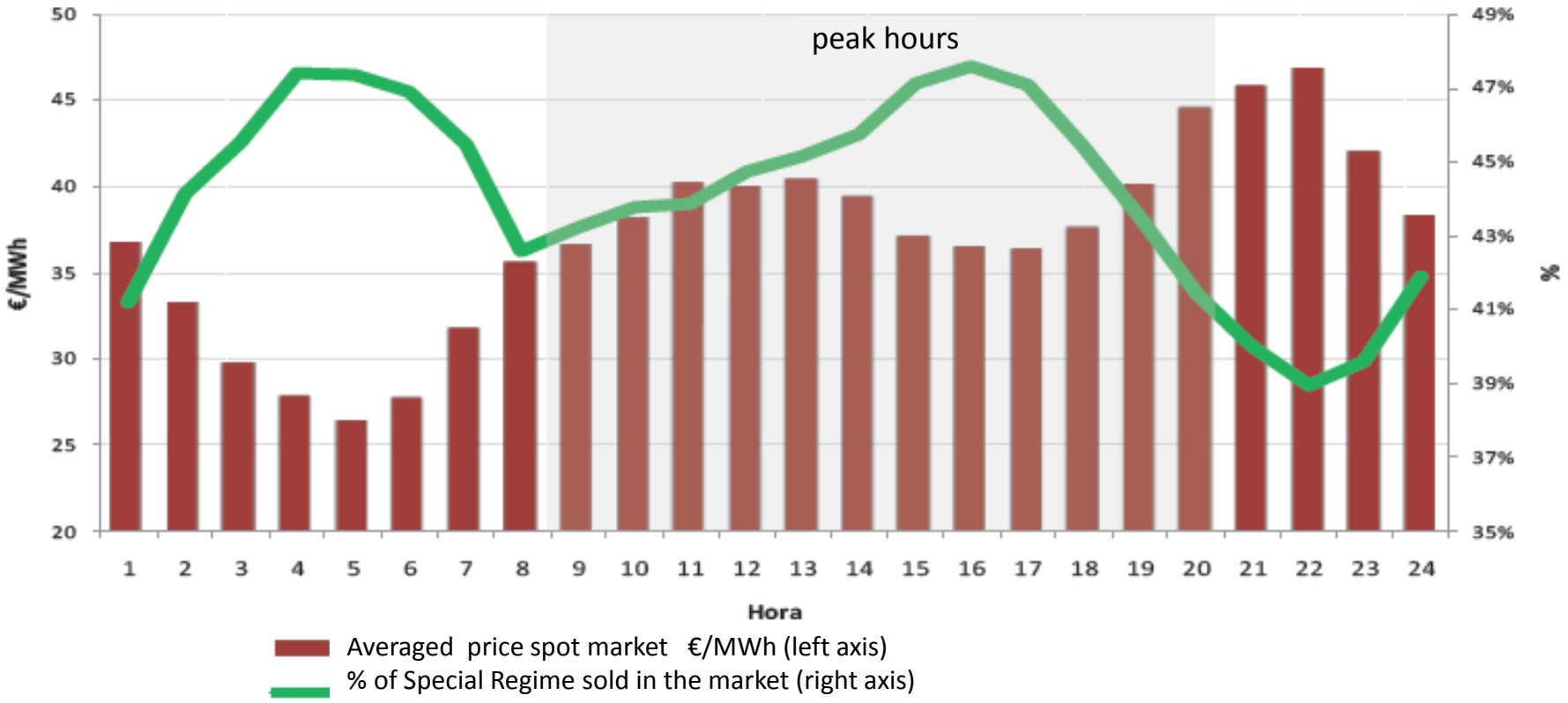
Benefits from feed-in tariffs: The “merit-order” effect



Ref: J. Fabra Utay, *Sostenibilidad económica y sostenibilidad medioambiental ¿son compatibles en el mercado eléctrico?,* CNE 2010

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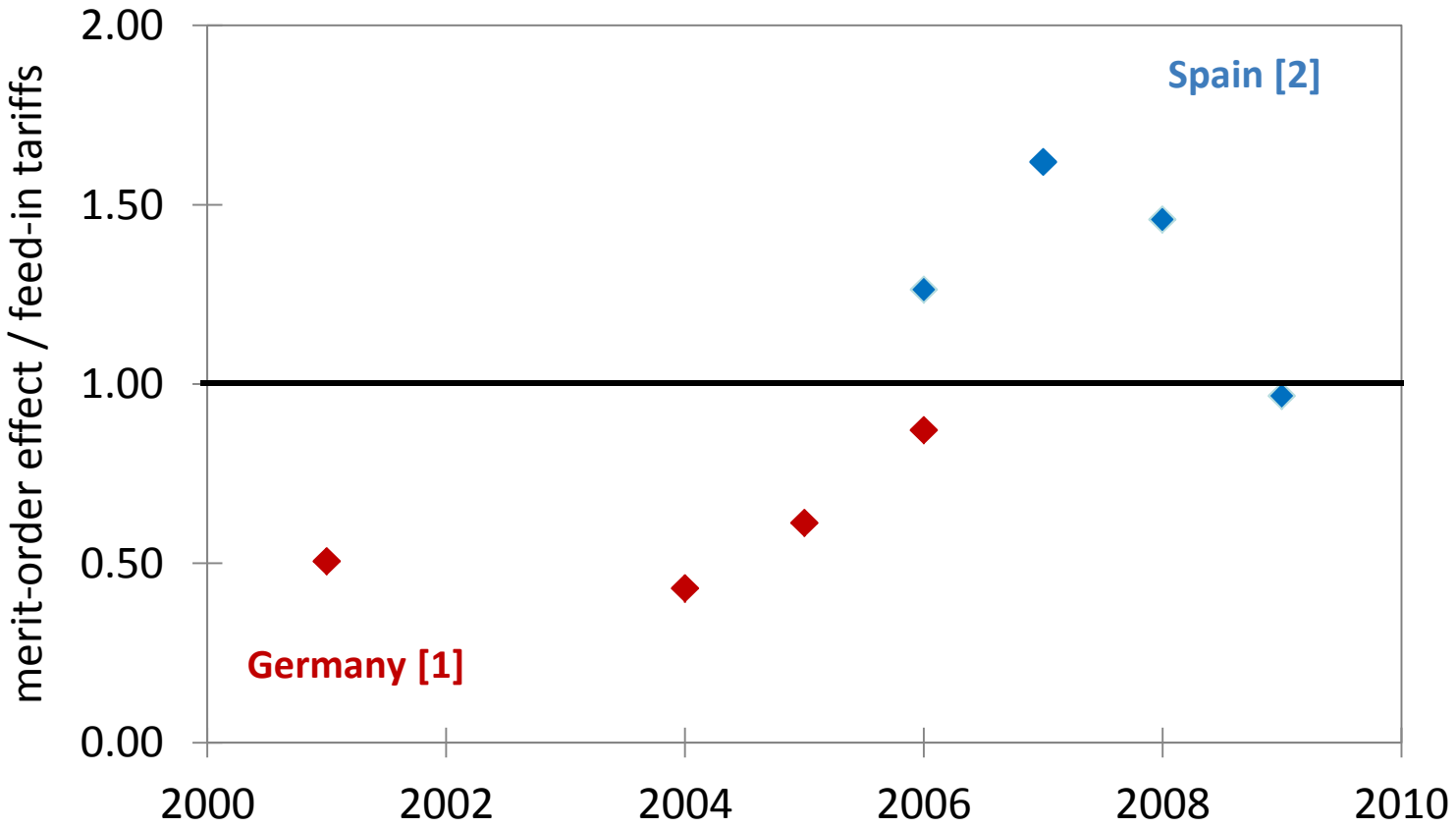
Benefits from feed-in tariffs: The “merit-order” effect



[1] Sensfus et. al, The merit-order effect. Working paper, Fraunhoffer ISI, 2007

[2] Estudio del impácto macroeconómico de las energías renovables en España, Deloitte, 2009

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The next future for wind and PV in Spain

1998 RD 2818/1998

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	Installed capacity 31/12/2011	Objective 2020
Wind	20.9 GW_P	35 GW_P + 0.75 GW_P (offshore)
PV	4.1 GW_P	7.2 GW_P

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The next future for PV in Spain: self consumption?

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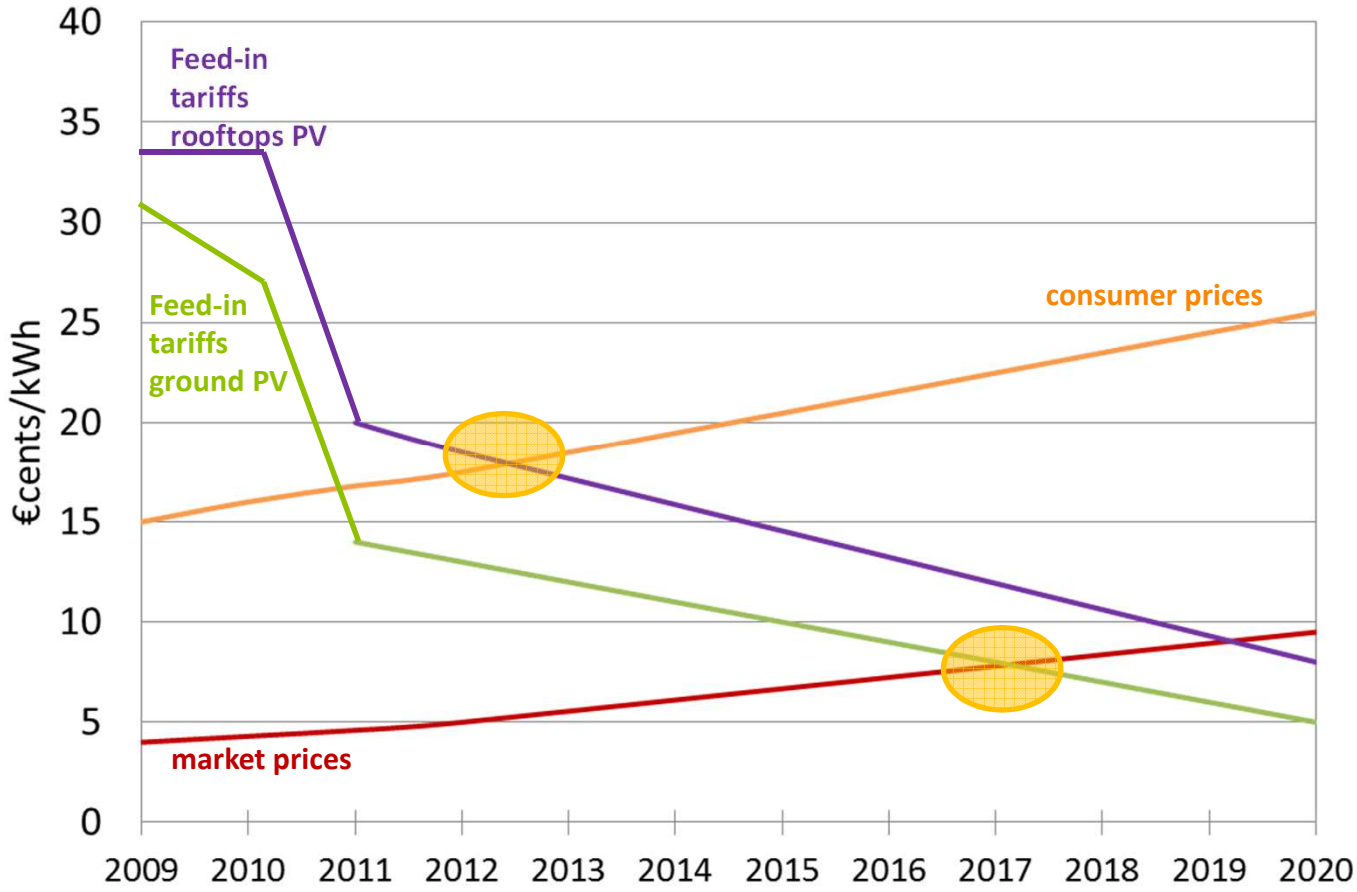

Ref: ASIF Report 2011, Towards a sustainable growth of photovoltaics in Spain

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The next future for PV in Spain: self consumption?

R.D.1699 or "the future?"

-PV can be connected to the house grid

-Abbreviated procedure for < 10kWp: simpler and quicker

-Net-metering: RD on to be published within 3 months

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Conclusions

- Last decade was extremely active in installation and regulation of wind and PV in Spain. In 2011 they generated respectively 16% and 3% of the electricity demand
- Regulation stability is compulsory to help the growth of renewable energy
- Economical benefits of renewable energy, as merit-order effect, should be taken into account when considering the admissible cost of feed-in tariff.
- Wind and PV will continue to grow during next decade in Spain. PV installed on building will shortly become cost-competitive.

Thank you very much for your attention !